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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/517,529	12/13/2004	Akira Unno	03500.017331	7094

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EXAMINER	
INGHAM, JOHN C	

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 05/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/517,529	UNNO, AKIRA	
	Examiner	Art Unit	
	John C. Ingham	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 February 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 February 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *11/21/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The amendments to the drawings filed on 16 February 2006 have been entered and made of record. The objections to the drawings have been withdrawn.

2. Amendments to the specification filed on 16 February 2006 have been entered and the objections withdrawn.

3. Applicant's remarks regarding the §112 rejection of claims 1-16 are persuasive and overcome the rejection in the Office Action mailed 13 October 2005.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims **1, 2, 11, 19, and 20** are rejected under 35 U.S.C. 102(b) as being anticipated by Baumbach.

With regards to claim **1**, Baumbach discloses in Figure 9 an organic semiconductor element comprising a gate electrode (51), a gate insulating layer (52), an organic semiconductor layer (58), source/drain electrodes (56) and a protective film (60), which are provided on a surface of a substrate (50), wherein an island-shaped protrusion layer (53) having dispersed and island-shaped protrusions (three instances of item 54) with a low surface energy (protrusions 54 made of polyimide, col 5. ln. 31-33) is

provided in contact with the organic semiconductor layer (contact made through layer 57, also polyimide, col. 5 ln 41-42).

6. With regards to claim **2**, Baumbach discloses in Figure 9 the organic semiconductor element according to claim 1, wherein between the gate insulating layer (52) and the organic semiconductor layer (58) is provided the island-shaped protrusion layer (53) having the dispersed and island-shaped protrusions (three instances of 54) with the low surface energy (protrusions 54 made of polyimide, col. 5 ln 31-33).

7. Regarding claim **7**, Baumbach discloses in column 5 lines 31-33 the element of claim 1, wherein the protrusions are made of polyimide (known to have a surface energy of 30 dyn/cm^2 or less).

8. Regarding claim **11**, Baumbach discloses in column 5 lines 31-33 that the protrusions with the low surface energy are made of polyimide.

9. With regards to claim **19**, Baumbach discloses in column 2, lines7-10 that the invention according to claim 1 may be utilized as an active matrix type display.

10. Regarding claim **20**, Baumbach discloses in column 2, lines 7-10 that the invention according to claim 1 may be utilized as an IC information electronic tag.

Claim Rejections - 35 USC § 103

11. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

12. Claims **3-6** are rejected under 35 U.S.C. 103(a) as being unpatentable over Baumbach. Baumbach discloses the organic semiconductor element according to claim

1, but does not teach the four rearrangements of layers recited in claims 3-6. However, regardless of the layer order, the organic material acts as the active layer. It would have been obvious to one of ordinary skill in the art at the time of the invention to change the order of layers to provide different means to make contact with the source, drain, and gate electrodes. See *In re Japikse*, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950).

13. Claims **1, 2, 7-10, and 14** are rejected under 35 U.S.C. 103(a) as being unpatentable over Jackson in view of Parikh.

14. Regarding claim **1**, Jackson discloses in Figure 4 an organic semiconductor element comprising a gate electrode, a gate insulating layer (gate dielectric), an organic semiconductor layer (90°C pentacene), and source/drain electrodes. Jackson does not disclose the protective film or an island-shaped protrusion layer having dispersed and island-shaped protrusions with a low surface energy provided in contact with the organic semiconductor layer, but does disclose an OTS layer (orientation layer) between the gate dielectric and organic layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to add the protective film to the structure recited by Jackson. Motivation to do so includes the necessity of a passivation layer covering sensitive electronic components, well known in the art.

Parikh discloses in the abstract and first paragraph of the introduction a description of an OTS layer molecular structure. Namely, in lines 10-12 of the abstract Parikh discloses that the OTS film exhibits closely spaced islands, arranged vertical to

the substrate surface, with a coverage dependant on temperature. It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teachings of Parikh to describe the island structure of the layer between the gate dielectric and organic layer of an OTFT, since highly organized films grow on the OTS layer as described (Jackson pg 102 paragraph 2), as well as having control over the surface energy depending on temperature, as disclosed in the abstract and on page 7581 (Parikh section 3.2 paragraph 2).

The combination of teachings from Jackson and Parikh (plus the well known passivation layer) results in a structure with a gate electrode, gate insulating layer, OTS film with island-shaped protrusions, organic layer, source/drain electrodes, and protective film on a surface of a substrate. The island-shaped protrusion layer resides between dielectric and organic layers, satisfying the limitation that the island-shaped protrusion layer is provided in contact with the organic semiconductor layer.

15. Regarding claim **2**, Jackson in view of Parikh disclose the organic semiconductor element according to claim 1, wherein between the gate insulating layer and the organic semiconductor layer is provided the island-shaped protrusion layer (OTS layer of Jackson as described by Parikh) having the dispersed and island-shaped protrusions with low surface energy.

16. With regards to claim **7**, Parikh discloses in Figure 1 that the surface energy of the OTS layer is dependent on preparation temperature, and the graph shows surface energy (surface tension) of the layer as below 30 dyne/cm.

17. Regarding claim **8**, Parikh discloses in Figure 2 that the proportion of the island-shaped protrusions dispersed in the island-shaped protrusion layer (film coverage) decreases as preparation temperature increases. Above 35°C, the coverage satisfies the limitation that the proportion of coverage is 10-95%.

18. With regards to claim **9**, Parikh discloses in the caption of Figure 2 that the figure is derived from a normalized film thickness of 26.2Å (2.62nm), satisfying the limitation that the height of the island-shaped protrusions is 0.2 to 150 nm.

19. Regarding claim **10**, Parikh discloses in column one on page 7586 (paragraph 4) that an average surface coverage of 90% results in close packed islands of 50 Å (5nm) width, satisfying the requirement that the average diameter of the island-shaped protrusions is 0.1 to 100 nm.

20. Regarding claim **14**, Jackson discloses in Figure 4 that the organic semiconductor layer is made of pentacene.

21. Claims **15 and 16** are rejected under 35 U.S.C. 103(a) as being unpatentable over Jackson and Parikh as applied to claim 1 above, and further in view of Shi et al.

22. Regarding claim **15**, Jackson and Parikh disclose the organic semiconductor element according to claim 1, but do not disclose wherein the organic semiconductor layer has periodicity with respect to a surface normal direction of the gate insulating layer (periodicity meaning a successive stacking of a single layer composed of pentacene molecules).

Shi et al. teaches in column 5 lines 2-5 that the organic material stacks with pi-electron overlapping aligned in the source to the drain direction, since the alignment and stacking creates the highest mobility in the source to drain direction within the organic material (Shi, col 4 ln 55-57). It would have been obvious to one of ordinary skill in the art at the time of the invention to perform the above described stacking in order to create high mobility.

23. Regarding claim **16**, Jackson and Parikh disclose the organic semiconductor element according to claim 1, but do not disclose wherein the organic semiconductor layer is made of a film of a pentacene derivative with a C-axis orientation of 85% or more.

Shi et al. teaches organic films made of pentacene derivatives in column 5 lines 19-21, used to advantage based on their low cost and simple application process (spin-coating and vacuum evaporation, col 1 ln 28-30). Shi also discloses in column 5 lines 2-3 that the organic material is deposited on top of the orientation film. In reference to the claim language pertaining to the C-axis orientation, the claiming of a new use, new function, or unknown property, which is inherently present in the prior art, does not necessarily make the claim patentable. (*In re Best*, 195 USPQ 430, 433 (CCPA 1977) and *In re Swinehart*, 439 F. 2d 210, 169 USPQ 226 (CCPA 1971); please see MPEP § 2112). Since Jackson, Parikh and Shi show all the features of the claimed invention, the characteristic C-axis orientation is an inherent property of the invention. It would have been obvious to one of ordinary skill in the art at the time of the invention to use a derivative of pentacene as an organic thin film because of its low cost.

24. Claims **17 and 18** are rejected under 35 U.S.C. 103(a) as being unpatentable over Baumbach as applied to claim 1 above, and further in view of Shi et al.

Regarding claim **17**, Baumbach discloses in Figs 6-8 a production method of an organic semiconductor element, comprising providing on a surface of a substrate (50) a gate electrode (51), a gate insulating layer (52), an organic semiconductor layer (58), source/drain electrodes (56) and a protective film (60), wherein an island-shaped protrusion layer (53) having dispersed and island-shaped protrusions (54) with a low surface energy (protrusions 54 made of polyimide) is formed in contact with the organic semiconductor layer. Baumbach fails to specify that the island-shaped protrusions are formed in a dispersed manner by spin coating or spray coating.

Shi teaches that organic films, such as polyimide, are desirable for use in TFTs because they have the advantage of being formed by the simple technique of spin coating at low temperatures (col 1 ln 30). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teachings of Shi on the structure of Baumbach in order to simplify the production method of the island-shaped protrusion layer of polyimide.

25. Regarding claim **18**, Shi discloses the method of claim 17, wherein after forming the island-shaped protrusion layer having the dispersed and island-shaped protrusions with the low surface energy (polyimide items 54 of Baumbach), which are formed by spin coating (taught by Shi), the organic semiconductor layer (pentacene layer taught by

Shi) is formed on the island-shaped protrusion layer under a heating condition of 200°C (col 5 ln 35).

26. The indicated allowability of claim **12** is withdrawn in view of the newly discovered reference(s) to Baumbach and Shi. Rejections based on the newly cited reference(s) follow.

27. Regarding claim **12**, Baumbach discloses the element of claim 1, but does not specify wherein the island-shaped protrusions are made of a fluorine-based polymer selected from the group consisting of polyfumarate-based polymers and cyclic perfluoropolymers.

Shi teaches suitable alternatives for polyimide, one of which is perfluoropolymers. It would have been obvious to one of ordinary skill in the art to combine the teachings of Shi with the structure of Baumbach, since art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

28. The indicated allowability of claim **13** is withdrawn in view of the newly discovered reference(s) to Baumbach and the English translation of JP 2001-94107. Rejections based on the newly cited reference(s) follow.

29. Regarding claim **13**, Baumbach discloses the elements of claim 1, but does not specify wherein the island-shaped protrusions are made of a fluorine-based polymer selected from fluoroalkylsilane compounds and perfluoroether based compounds.

The English translation of the JP '107 patent teaches that a perfluoropolyether ingredient is used as a fluorine polymer for an organic semiconductor layer, and lists formulas corresponding to these ingredients (¶ 32-41).

It would have been obvious to one of ordinary skill in the art to combine the teachings of the JP '107 patent with the structure of Baumbach, since art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

Response to Arguments

30. Applicant's arguments filed 16 February 2006 with respect to claims 1, 2, 7, 11, and 19-20 (Baumbach reference) have been fully considered but they are not persuasive. Applicant states that Baumbach's patterned isolation layer (54) is a continuous layer, but the claims do not recite (nor do the figures show) anything other than a continuous film of pentacene with protrusions of polyimide upon it. A broad interpretation of the language of claim 1 applies to an orientation film rubbed until protrusions occur, and also applies to a patterned polyimide film.

31. Applicant's arguments filed 16 February 2006 with respect to claims 1, 2, 7-10, and 14 (Jackson in view of Parikh) have been fully considered but they are not persuasive. Examiner concedes that Jackson does not describe a protective layer or island shaped protrusion, though Jackson does disclose an OTS layer. Parikh describes a method for forming closely spaced islands on an OTS film, and the motivation is stated, "molecular level control over structural order and composition"

(Parikh line 2 of introduction). Applicant also argues that the OTS treatment described in Parikh does not relate to an organic semiconductor. This is unpersuasive, because Jackson relates the OTS layer to an organic semiconductor, while Parikh teaches the molecular structure of the OTS.

32. Applicant's arguments, see page 11, filed 16 February 2006, with respect to the rejection(s) of claim(s) 17 and 18 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Baumbach and Shi.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John C. Ingham whose telephone number is (571) 272-8793. The examiner can normally be reached on M-F, 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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Examiner
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PRIMARY EXAMINER